Saturn during the 2006/2007 apparition

Mike Foulkes

A report of the Saturn Section (Director: Mike Foulkes)

This report provides an analysis of the observations of Saturn made by members of the BAA Saturn Section during the 2006/2007 apparition.

Summary

There were two major events during this apparition.

Firstly, a light spot was observed between the components of the South Equatorial Belt and was followed from 2006 November until 2007 April. A reliable drift was derived; this spot showed a noticeable prograde (negative) drift with respect to Saturn's System 3 longitude system. The derived period for this spot may be a potential first for the Section, but this will be confirmed when the analysis of earlier outstanding apparitions has been completed.

Secondly, the initial phase of a rare transit of the satellite Iapetus was successfully observed on the night of 2007 January 6/7.

A number of other features were noted. The South Equatorial Belt was the most readily observed feature on the planet's disk. This belt was double and both components were visible even in relatively small aperture telescopes. The northern component was darker than the southern component.

The South Polar Band was also conspicuous and appeared almost as intense as the northern component of the South Equatorial Belt. The zone immediately to the south of the South Polar Band showed a distinct reddish colouration.

The brightest region on the planet was the southern half of the Equatorial Zone. A few light and dark spots were intermittently detected on the Equatorial Zone and at a number of other latitudes in the southern hemisphere. Generally, each of these spots was only observed on a single night so they may only have been temporary features.

More of the northern hemisphere could be observed compared to the previous apparition, as a result of the reduced apparent inclination of the planet's south pole with respect to the Earth. The most striking feature in this hemisphere was the North Tropical Zone which showed a noticeable turquoise colour. The rest of this hemisphere had a distinctly cold tone.

During 2007, there were several lunar occultations of Saturn and two were visible from large parts of the UK. Both events were successfully observed by Section members.

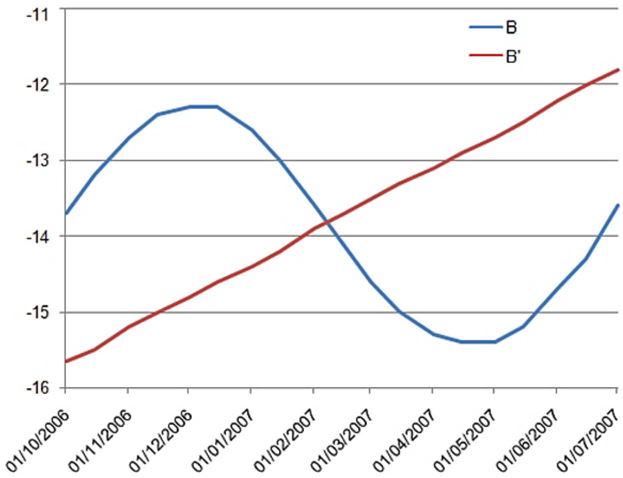

Figure 1. The variations in Saturn's polar (and ring) inclination as seen from Earth (parameter B) and from the Sun (parameter B') during the 2006/2007 apparition. Negative values indicate that the south pole was inclined towards the Earth and the Sun.

Table 1. Visual observers, 2006/2007

Observer	*Location*	*Telescope**
Paul G. Abel	Leicester, UK	200mm Newt.
Guianluigi Adamoli	Verona, Italy	125mm Mak.
Emilio Colombo	Cambio, Italy	150mm Newt.
Mike Foulkes	Henlow, Beds., UK	203mm SCT
David Graham	Richmond, N. Yorks, UK	150mm OG & 230mm Mak.
David Gray	Kirk Merrington, Co. Durham, UK	415mm DK
Alan Heath	Long Eaton, Notts., UK	203mm SCT & 250mm Newt.
Richard McKim	Upper Benefield, Northants., UK	410mm DK
Peter Parish	Rainham, Kent, UK	152mm OG
Ian Phelps	Warrington, Cheshire, UK	215mm Newt.

**DK= Dall–Kirkham Cassegrain; Mak.= Maksutov; Newt.= Newtonian; OG= Refractor; SCT= Schmidt–Cassegrain.*

Introduction

Saturn re-emerged in the morning sky following solar conjunction on 2006 August 7. Opposition occurred on 2007 February 10 at 19h UT.[1] At opposition, the planet had a magnitude of 0.0 and lay in the constellation of Leo to the west of Regulus. The major axis of the rings appeared approximately 46 arcseconds across and the planet appeared 20.3 by 18.4 arcseconds. Saturn was again in conjunction with the Sun on 2007 August 21.[1]

Saturn's south pole and hence the south face of the rings were inclined towards both the Earth and the Sun. The variation of the apparent inclination of the south pole as seen from Earth (designated by the parameter B) coupled with that seen from the Sun (designated by the parameter B') during the period covered by this report is shown in Figure 1.

During the first half of the apparition, Saturn's south pole was inclined at a greater angle to the Sun than to the Earth. Approximately two days prior to opposition, the inclinations to the Earth and Sun were identical. At opposition, the inclination towards the Earth was –13.87°. After opposition the south pole was inclined at a greater angle to the Earth than to the Sun.

Observations

The observations received for this apparition cover the period from 2006 October 4 (Tyler) until 2007 June 23 (Colombo). The observers who contributed visual observations are shown in Table 1 and those who contributed digital and photographic observations are shown in Table 2.

A wide range of telescope apertures was used. Gray and McKim were able to produce a number of high resolution visual observations with their large aperture telescopes. Gray also made a number of colour drawings with his 415mm closed tube Dall–Kirkham telescope. These drawings were generated with Corel Draw *PhotoPaint* software. Eheim & Vedovato were able to provide some images taken with an even larger instrument, namely the 800mm Cassegrain telescope at the Max Valier Observatory in Bozen, Italy. However by far the largest instrument used was by Hill. He was able to image the planet using the 60-inch [1.52m] reflector of the Steward observatory on Mount Lemmon, Arizona, USA, as well as taking images with his own telescope.

Many observers who used digital cameras were routinely able to generate high resolution images when seeing permit-

Table 3. Saturnographic latitudes of the belts, 2006/2007

Belt	*Latitude (°)*	*No. of measurements*	*Standard deviation*
SPR Band s	−65.4	10	1.7
SPR Band n	−61.9	10	1.4
SSTBc	−54.9	6	1.0
STB(S)s	−49.0	10	1.0
STB(S)n	−44.8	9	1.4
STB(N)s	−41.8	9	1.2
STB(N)n	−39.5	10	0.6
SEB(S)s	−35.4	10	1.0
SEB(S)n	−29.9	10	0.6
SEB(N)s	−25.2	10	1.1
SEB(N)n	−19.0	10	0.8
C of narrow belt in southern EZ	−15.4	4	0.5
EBs	−9.4	10	1.1
EBn	1.2	10	1.1
Centre of NTropZ Band	31.7	5	1.5
NTBs	35.8	10	1.4
NTBn	46.3	10	1.2

Measurements were made from images taken by Lawrence, Peach, Tyler and Eheim & Vedovato over the period 2007 February 1 to April 25.

Table 2. Photographic and digital imaging observers, 2006/2007

Observer	*Location*	*Telescope**	*Camera*	*Filters** (IR blocking plus:)*
David Arditti	Edgeware, Middx., UK	254mm DK	Mono ToUcam	R, G, B
Richard Best	Lewes, East Sussex, UK	356mm SCT	Lumenera LU-075M	R, G, B
Stefan Buda	Melbourne, Australia	405mm DK	ToUcam 740	UV blocking
Paulo Casquinha	Palmela, Portugal	250mm Newt.	Lumenera Skynyx 2.0	R, G, B
Oskar Eheim & Marco Vedovato,	Max Vallier Obs., Bozen, Italy	800mm Cass.	Vesta webcam & Starlight SXV M7 CCD	R, G, B, IRT
Mike Foulkes	Henlow, Beds., UK	203mm SCT	ToUcam & Atik 1HS	IRT
Ian Hancock	Canterbury, Kent, UK	254mm SCT	Lumenera LU-075M	
Richard Hill	Tuscon, Arizona, USA	356mm SCT	ToUcam	
	Steward Observatory, Mt Lemmon, USA	1524mm (60 inch) Refl.	ToUcam	
Peter Lawrence	Selsey, UK	356mm SCT	Lumenera Skynyx 2.0M	R, G, B
Peter Lyon	Quinton, Birmingham, UK	203mm SCT	Nikon film & Fuji digital compact	UV blocking
Cliff Meredith	Prestwich, Manchester, UK	215mm Newt.	ToUcam	
Martin Mobberley	Cockfield, Sussex, UK	245mm Newt.	Lumenera, LU-075M	R, G, B
Damian Peach	Loudwater, Bucks., UK	235mm & 356mm SCT & 152mm OG	Lumenera Skynyx 2.0M	R, G, B, Schott RG1000 (1000nm), Schuler UV (375nm)
Zac Pujic	Brisbane, Australia	310mm Newt.	ToUcam & Lumenera Skynyx 2.1M	Methane 889nm & Schuler UV (359–400nm)
Ian Sharp	Ham, West Sussex, UK	150mm OG	Atik 1HS	R, G, B
John S. Sussenbach	Houten, The Netherlands	280mm SCT	ToUcam & Atik 2HS	R, G, B
David Tyler	High Wycombe, UK	356mm SCT & 152mm OG	Lumenera LU-075M	R, G, B, Y
Ralf Vandebergh	Wittem, The Netherlands	250mm Newt.	ToUcam	R, G, B, UV (350nm)
Jim Vincent	Chelmsford, Essex, UK	203mm SCT	ToUcam	–
Sean Walker	Chester, NH, USA	318mm Newt.	Lumenera LU-075M	R, G, B
Kenkichi Yunoki	Sakai City, Osaka, Japan	260mm Newt.	Atik 1HS II & ToUCam Pro	Wr (Wratten) 25a R, Wr 21 orange, Wr 58 G, Wr 80A B, IRT (700nm), Methane (890nm), UV (300–400nm)

**Cass.= Cassegrain; DK= Dall–Kirkham Cassegrain; Mak.= Maksutov; Newt.= Newtonian; OG= Refractor; Refl.= Reflector; SCT= Schmidt–Cassegrain. **Filters: R= Red, Y= Yellow, G= Green, B= Blue; IRT= Infrared transmission.*

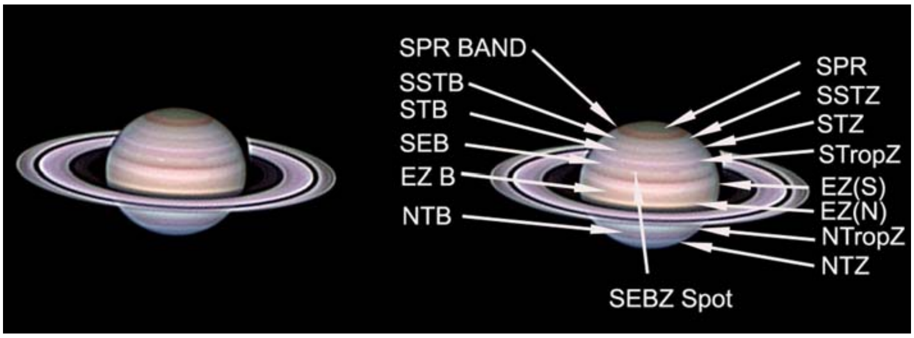

Figure 2. Illustration of the belt and zone nomenclature used in this report. Based on an image by Peach on 2007 Mar 14d 20h 20m. CM1= 191.8, CM2= 103.0. CM3= 105.9. High contrast processing was used in order to emphasise the belts and zones. *Left*: The un-annotated image shows the bright SEBZ spot no.1 and a darker marking on the north edge of the SEB(S) as described in the text. *Right*: The same image annotated with the belt and zone nomenclature used in this report.

ted. Red, green and blue filters were often used in conjunction with monochrome cameras in order to generate colour composite images. A number of observers also used filters at other wavebands (see Table 2).

Several observers used high contrast processing techniques in an attempt to reveal the fainter belts and spots. In particular, this was undertaken by Vandebergh who provided many highly processed images.

The *WinJUPOS* software[2] was used to derive latitude and longitudes of all spots recorded on the digital images plus the latitudes of the major belts and zones. All such measurements were made by the Director using version 7.5.14 of this software.

A few spots were recorded visually, and a small number of visual central meridian transit observations were made by Gray.

Lyon photographed Saturn on a number of nights. These photographs were then digitised, and those taken on the same night were stacked and processed with the *Registax* software.[3] The resulting processed images had better definition than the individual photographs.

A number of other observers only provided observations of the lunar occultations of Saturn. These observers are not shown in Tables 1 and 2 but are referenced below.

Nomenclature

Saturn shows a pattern of alternating belts and zones similar to those observed on Jupiter, so the belt and zone naming convention used for Saturn is also similar.

Recent high resolution amateur observations (including those shown in this report) show more belts and zones than were normally revealed in observations made during the last century. In some instances, it is not always obvious what the designations of a number of the belts and zones should be. Consequently it is intended to derive belt and zone latitudes from observations made in this, previous and subsequent apparitions in order to:

1 provide a more consistent belt and zone naming convention based on latitude;

2 establish if the belt and zone latitudes show any significant variation from apparition to apparition.

However as an interim measure, a belt/zone nomenclature has been defined for use throughout this report and this is shown in Figure 2. This nomenclature may be revised in the future when more belt and zone latitude data are available.

Standard abbreviations for the belt and zone names are used throughout this report (*e.g.* the South Equatorial Belt is abbreviated to the SEB). When a belt is double, the north and south components are abbreviated, for example on the SEB as the SEB(N) and SEB(S) respectively. The north and south edges of a belt are abbreviated, for example on the SEB as SEBn and SEBs respectively.

The central meridian is abbreviated to CM. The central meridian longitudes in Systems 1, 2 and 3 are abbreviated respectively to CM1, CM2 and CM3. The longitudes of a feature in Systems 1, 2 and 3 are abbreviated to L1, L2 and L3 respectively.

All images shown in this report are oriented with south upwards and with the preceding (p.) edge to the left. This is the view seen in an inverting telescope from the northern hemisphere.

Figure 3. Drawings of Saturn. These drawings plus the images in Figure 4 show a number of features described in the text. They also show the variations in the position of the globe shadow on the rings and of the ring shadow on the globe during the apparition.

Figure 3a. 2006 Oct 18d, 05h 50m UT. CM1= 120.3, CM2= 119.4, CM3= 300.3 *(Gray)*. Colour image generated using Corel Draw *PhotoPaint*. Note the detail on the rings, the colour of the NTropZ and the faint belt between the SEBn and the EZBs.

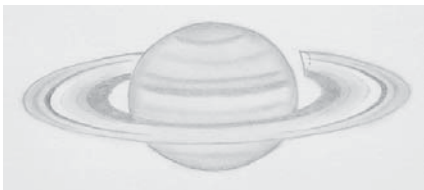

Figure 3c. 2007 Apr 14d, 20h 40m UT. CM1= 95.9, CM2= 85.5, CM3= 51.0. *(Graham)*. Note the detail on Ring B and the Terby white spot adjacent to the globe shadow on the rings.

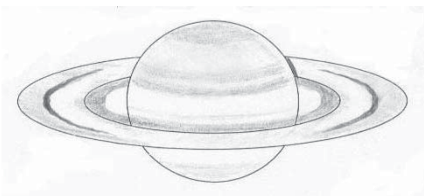

Figure 3b. 2007 Feb 07d, 20h 30m UT. CM1= 217.9, CM2= 151.8, CM3= 182.4. *(Adamoli)*. Note the double SEB and visibility of Ring C.

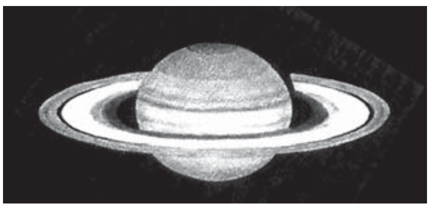

Figure 3d. 2007 May 07d, 20h 55m UT. CM1= 81.6, CM2= 47.9, CM3= 345.7. *(Parish)*.

Figure 4. Images of Saturn.

These images, as do the drawings in Figure 3, show a number of features described in the text.

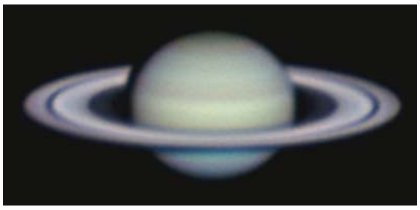

Figure 4a. 2006 Oct 17d, 04h 55m UT. CM1= 323.8, CM2= 356.8, CM3= 178.6. *(Tyler).* Early observation of this apparition showing the broad ring shadow projected onto the globe north of the rings plus the turquoise NTropZ.

Figure 4b. 2007 Jan 14d, 16h 26m UT. CM1= 277.0, CM2= 299.2, CM3= 13.4. *(Yunoki).*

Figure 4c. 2007 Feb 7, 00h 26m UT. CM1= 179.5, CM2= 168.0, CM3= 214.1. *(Lawrence).* Shows the reddish coloured zone in the SPR and the turquoise coloured NTropZ. The shadow of the globe on the rings has virtually disappeared. The sector of the Cassini Divison where projected onto the planet appears light.

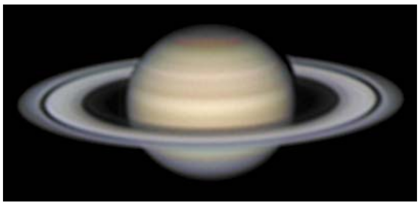

Figure 4d. 2007 Feb 27d, 23h 59m UT. CM1= 253.3, CM2= 286.1, CM3= 306.9. *(Casquinha).* The shadow of the rings on the globe has now disappeared behind the rings.

Figure 4e. 2007 Mar 12d, 23h 15m UT. CM1= 45.8, CM2= 17.7, CM3= 22.8. *(Meredith).*

Figure 4f. 2007 Mar 16d, 21h 52m UT. CM1= 134.5, CM2= 339.0, CM3= 339.4. *(Eheim & Vedoveto).* The ring shadow on the globe can be seen though Ring C where it crosses the planet.

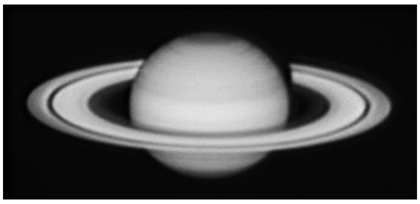

Figure 4g. 2007 Mar 18d, 05h 52m UT. CM1= 180.1, CM2= 341.6, CM3= 340.4. *(Hill).* Image taken with the 60-inch reflector at the Steward Observatory, Mount Lemmon.

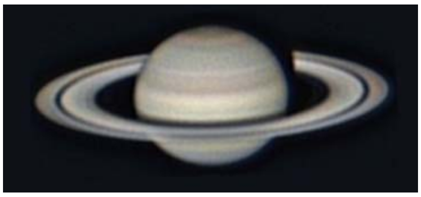

Figure 4h. 2007 April 10, 22h 08m UT. CM1= 10.4, CM2= 127.2, CM3= 97.4. *(Vandebergh).*

Figure 4i. 2007 April 11, 10h 09m UT. CM1= 73.3, CM2= 173.9, CM3= 143.5. *(Buda).* Note the visibility of the p. limb of the planet through the Cassini Division.

Figure 4j. 2007 April 28d, 19h 44m UT. CM1= 2.2, CM2= 260.8, CM3= 209.5. *(Arditti).*

Latitudes

Several of the highest resolution digital images were measured by the Director using the *WinJUPOS*[2] software in order to derive the average latitudes of the major belts. The results are shown in Table 3.

Visual intensity and colour observations

Several observers provided visual intensity estimates of the belts, zones and rings. The average intensities of each feature derived from each observer's estimates are shown in Table 4.

Table 5 shows the visual colour estimates. Colour information is also contained within the digital colour images. However no satisfactory method of extracting this information has been established.[4] Consequently, Table 5 also shows a visual interpretation by the Director of the colours of the major belts and zones shown in some of the best colour images. Although this interpretation is subjective, it does give an overview of the colours shown by such images.

The planet

South Polar Region (SPR)

The most prominent feature at high southern latitudes was a dark belt which has been designated as the South Polar Band (SPB). This is shown in Figure 5 and in many of the other figures of this report. As a whole, this belt appeared of a similar intensity to the SEB(N) and its northern edge was generally darker than its southern edge. A faint southern component was visible on some of the higher resolution images by Peach and Eheim & Vedovato.

The region to the south of the SPB is usually designated as the South Polar Region (SPR). At low resolution, this appeared as a grey region extending up to the south pole. However more structure was revealed in higher resolution observations, especially in images taken in red light.

Immediately to the south of the SPB was a broad zone extending southwards approximately to a latitude of 72ºS. This zone showed a distinct reddish colouration and was bright in images taken in red light. This reddish colour contrasted with the grey colouration of the region further to the south which is usually designated as the South Polar Cap (SPC). Observations by Eheim & Vedovato, Gray, Peach and Tyler sometimes showed the SPC to have a darker rim.

The maximum apparent inclination of the south pole with respect to the Earth during this apparition occurred towards the end of April as shown in Figure 1. The highest resolution images made around this time revealed a small dark spot situated at or close to the pole itself, which in turn was surrounded by a narrow light zone (Figure 5).

Two dark spots were observed in this region. Firstly, a dark spot was observed on the northern edge of the SPC on April 18 (Figure 6) at an approximate L3= 48º with an approximate latitude of 70ºS. This was first imaged by Peach when the spot lay following (f.) the CM and was immediately confirmed by Tyler who was in communication with Peach at the time. The spot was then followed by both observers as the planet's rotation carried it past the CM. The spot appeared in both red and yellow light images. It was centred in a light patch which was more prominent to the south and which broke into the rim of the SPC.

Secondly, Vandebergh recorded a dark spot on the SPR band on April 17. Neither of these spots was recorded again so they may have been temporary.

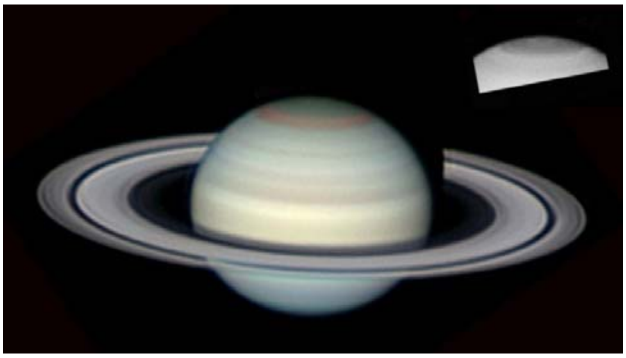

Figure 5. 2007 Apr 21d, 19h 50m UT. CM1= 216.2, CM2= 340.8, CM3= 297.9. *(Tyler).* This image shows details in the SPR. The inset is a red light image taken on the same night showing details at the south pole which are described in the text. Note also the visibility of the p. limb of the planet through the Cassini Division.

South South and South Temperate Regions

At lower resolution, the region between the South Temperate Belt (STB) and SPB appeared as a uniform broad zone. However higher resolution observations showed that this region was divided into a STZ and SSTZ separated by a very faint, grey and double SSTB. Some high resolution images taken during the previous apparition show a more prominent double SSTB (Figure 7), indicating that this belt may have faded between the two apparitions. This result will be confirmed when the detailed analysis of the previous apparition observations has been completed.[5]

Table 4. Average visual intensity estimates, 2006/2007

	Adamoli (Dec 12 - June 20)	*Abel (Apr 21 - June 4)*	*Colombo (Apr 9 - June 23)*	*Foulkes (Nov 11 - May 29)*	*Gray (Oct 8 - May 5)*	*Hancock (Mar 13 - May 19*	*Heath (Jan 26 - April 4).*	*McKim (Jan 7 - May 5)*	*Phelps (April 11)*	*Apparition Average*	*Total No of Obsns*
SPR Cap					5.0 (46)		3.5(2)	6.0 (11)		5.1	59
SPR Cap Rim		3.6 (13)[1]		3.6 (48)	5.8 (46)	4.0 (3)[1]				4.7	94
SPR Zone					4.3 (46)		3.0 (9)	5.1 (14)		4.2	85
SPR Band				5.0 (42)	5.2 (46)			5.5 (11)	5.5 (1)	5.2	100
SSTZ					3.6 (18)					3.6	18
SSTB					4.3 (17)					4.3	17
STZ	2.5 (13)	2.0 (13)	3.0 (4)	3.5 (32)	3.2 (46)			3.5 (14)		3.1	122
STB(S)					4.8 (46)					4.8	46
STB (N)		3.0 (12)			4.2 (45)	3.0 (4)		4.1 (10)	3.5 (1)	3.9	72
STropZ	2.4 (13)			2.5 (42)	2.7 (46)		2.5 (9)	3.3 (14)	2.0 (1)	2.6	125
SEB(S)	4.3 (13)	4.1 (13)	3.4 (4)	5.1 (48)	5.3 (46)			5.2 (14)	6,5 (1)	5.0	139
SEBZ	2.8 (8)		3.4 (4)		4.1 (46)	3.6 (4)[2]	5.0 (9)[2]	3.8 (11)		3.9	69
SEB(N)	4.5 (13)	5.0 (13)	3.6 (4)	5.5 (48)	5.8 (46)			5.2 (14)	6.5 (1)	5.3	152
EZ(S)	1.4 (13)	1.9 (13)	2.1 (4)	1.5 (48)	1.4 (46)		1.5 (9)	1.9 (14)		1.6	150
EB	3.6 (9)			2.0 (35)	3.3 (46)	1.7 (3)[3]	2.1 (6)	3.6 (13)	5.0 (1)	2.9	110
EZ(N)		2.5 (13)			1.9 (46)			2.0 (14)		2.0	73
NTropB					3.5 (27)					3.5	27
NTropZ	1.8 (8)		3.2 (4)		2.9 (46)			2.8 (13)	2.5 (1)	2.8	72
NTB	3.7 (13)	3.5 (2)			4.4 (45)			4.2 (11)	4.0 (1)	3.5	111
NTZ				3.5 (30)[4]	3.6 (46)		4.0 (9)[4]	3.0 (13)		3.5	71
N LIMB REGION		3.5 (12)[5]			5.5 (45)			3.8 (7)		5.3	52
Ring A1					3.9 (46)	3.5 (4)	3.0 (9)	3.1 (14)		3.6	151
Middle zone	4.8 (13)[6]	2.7(13)[6]	3.2 (4)[6]	3.5 (48)[6]	4.6 (35)	4.7 (3)	3.6 (11)	4.2 (1)		4.4	50
Ring A2					3.1 (46)	2.9 (4)	1.5 (9)	2.7 (14)		2.8	73
Cassini Division	9.9 (13)	10.0 (13)		10 (38)	8.6 (46)	8.9 (4)	10.0 (9)	10.0 (14)	9.5 (1)	9.5	140
Ring B1	1.4 (13)	1.0 (13)		1.0 (48)	1.4 (46)	1.0 (4)	1.0 (9)	1.4 (14)	2.0 (1)	1.2	148
Ring B2	2.7 (13)	3.2 (11)		3.1 (39)	2.7 (46)	2.0 (4)	1.5 (9)	2.7 (13)	3.5 (1)	2.8	136
RING B3					4.1 (46)					4.1	46
Ring C	8.9 (10)	7.7 (13)	9 (1)	8.1 (9)	7.1 (45)	8.5 (2)	8.5 (9)	7.0 (13)	6.5 (1)	7.6	103
Ring C(M)	7.4 (13)		9 (1)	7.5 (11)	5.4 (44)		8.7 (7)	8.3 (14)		6.7	90
SH G on R	10.0 (11)	9.8 (13)	10 (4)	10 (44)		10.0 (3)	10.0 (9)	10.0 (14)	9.5 (1)	10.0	99
SH R on G	9.0 (2)	10.0 (13)		10 (35)	9.3 (44)	8.0 (2)		10.0 (5)	10.0 (1)	9.6	102

Intensity estimates are made on the scale 0= bright white, 10= black. The number of observations made by each observer is shown in brackets.
Gray systematically recorded rings A1 and A2 to be brighter in the p. ansa than the f. However only average values are given in this table.
Gray also recorded variations between the intensity of Ring C in the p. and f. ansae but again only average values are given in this table.

1 These intensities have been allocated to the average for the SPR Zone.
2 These intensities have been allocated to the average for the SEB(N).
3 These intensities have been allocated to the average for the EZ(S).
4 These intensities have been allocated to the average for the NTB.
5 These intensities have been allocated to the average for the NTZ.

Table 5. Colour estimates, 2006/2007

	Adamoli (Dec 12 - June 20, 9 nights)	Colombo (Apr 9 - June 23, 4 nights)	Foulkes (Nov 11 - May 29, 48 nights)	Heath (Jan 26 - April 4, 9 nights).	McKim (Jan 6 - May 5, 14 nights)	Digital images (interpreted by MF)
SPR	Grey	Yellow grey	Grey			Grey
SPR Zone				Warm grey	Brown	Reddish
SPR Band			Brown		Brown	Greyish brown.
SSTZ						Light grey. Some images show a green tinge
SSTB						Grey
STZ	Yellow				Yellow or grey	Light grey. Some images show a green tinge
STB			Grey		Grey	South component greyish brown. North component grey
STropZ		Yellowish	Yellow		Yellow	Light grey or dull white
SEB(S)	Grey brown or brown	Orange grey	Grey brown		Orange brown	Grey brown.
SEBZ				Grey		Dull white or yellow
SEB(N)	Grey brown or brown	Orange grey	Grey brown		Orange brown	Warm brown
EZ(S)	Yellow or yellowish white	Yellow	Yellow or cream	Off white	Yellow or strong yellow.	Cream or yellowish white
EB					Grey	Grey or warm grey
EZ(N)					Yellow	Cream or yellowish white
NTropZ	White		Grey or blue grey		Bluish or slightly bluish	Turquoise
NTB	Grey blue	Grey		Blue grey	Bluish or slightly bluish or bluish gray.	Grey. Sometimes a bluish tone
NTZ					Bluish or slightly bluish	Grey
NHEM						Grey
RING A1	Grey blue		Grey blue	Grey	Grey	Grey
Middle zone		Grey				
Ring A2			Grey Blue	Off white	Grey	Bluish grey
Cassini's Division	Black					Black
Ring B1	White	Cream		White	White	White
Ring B2				Light grey	Grey	Grey
Ring C				Brownish	Grey	Grey
Ring C(M)	Grey					Grey
SH G on R	Black				Black	Black
SH R on G	Black				Black	Black

Abel and Graham also made a limited number of colour estimates for a few belts/zones.

Generally, the SSTZ appeared narrower than the STZ, when visible. Some spots were observed in this region and may have been temporary as each was only observed on a single night.

On April 18, Peach imaged a light spot in the centre of the SSTB at an approximate L3= 46º. (This was the same night that he and Tyler imaged a dark spot on the northern edge of the SPC described above). This was visible in green light images (Figure 8) but was only faintly visible in red light images (Figure 6). Subsequent observations on this night showed that this spot moved with the rotation of the planet.

Vandebergh recorded a light spot in the STZ on April 15 and again on April 22, but at a different longitude.

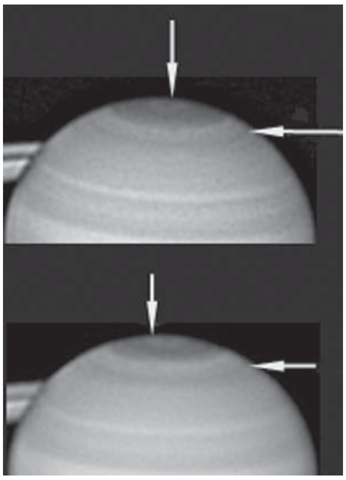

Figure 6. Red light images showing a spot on the northern edge of the SPC. The position of the spot is indicated by arrows. *Upper:* 2007 Apr 18d, 20h 13m UT. CM1= 217.0, CM2= 78.0, CM3= 38.7. *(Peach). Lower:* 2007 Apr 18d, 20h 51m UT. CM1= 239.3, CM2= 99.4, CM3= 60.1. *(Tyler).* Note the rotation of the spot between the two images. The upper image also shows a faint spot on the SSTB which is more easily seen in the green light image of Figure 8.

South Temperate Belt (STB)

The STB was a broad double belt. The southern component generally appeared darker and warmer in tone than the northern component although both appeared of equal intensity in an image taken by Peach on January 25. The northern component appeared to have faded slightly from the 2005/2006 apparition. (Figure 7).

Some dark spots were occasionally reported on the STB(N). (Casquinha on Feb 4, Gray on March 6 and March 13, and Vandebergh on April 9.). None of these could be tracked, like many of the other spots observed during this apparition.

South Tropical Zone (STropZ)

This was a narrow but bright zone.

Some of the images taken by Casquinha, Vandebergh and Yunoki between 2006 November 30 and 2007 April 20 showed some light spots in this zone. Generally, these spots were only visible in high contrast images and even in such im-

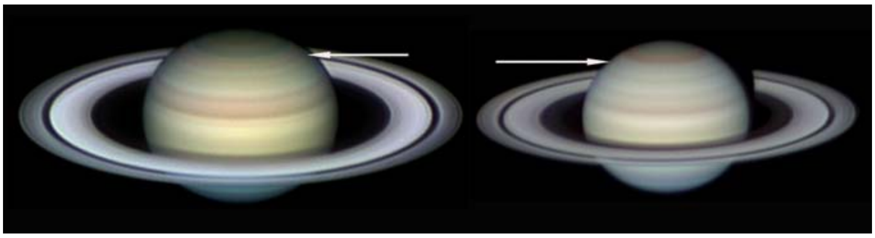

Figure 7. A comparison of the appearance of the SSTB during the 2005/2006 and 2006/2007 apparitions. Images by Peach. *Left:* 2006 Jan 23d, 23h 59m UT. CM1= 227.7, CM2= 218.5, CM3= 297.9. *Right:* 2007 Apr 10d, 20h 17m UT. CM1= 305.5, CM2= 64.7, CM3= 35.1. The position of the SSTB is indicated by arrows.

ages, they often appeared faint. Some images taken on the same night showed movement of these spots with the planet's rotation. The centres of the majority of these spots lay within the approximate longitude band of L3= 190º to L3= 260º. In particular, there were six observations lying in the narrow longitude band L3= 237º to L3= 243º which included a white spot that extended into the STB(N). (Casquihna on Feb 27). However it is difficult to assess if these observations were of a single object, as all of them are widely spaced in time and none of these spots are shown in the few observations of this longitude band made on other dates.

Whether these spots represent a continuation of the spot activity observed at these latitudes during the previous apparition will be investigated in the 2005/2006 apparition report.[5]

South Equatorial Belt (SEB)

The SEB was the most prominent belt. It appeared double and both components were visible even with relatively small instruments (Figure 3b). These components were separated by a light narrow zone (the SEB Zone (SEBZ)). Both components had a brown colour but generally the SEB(N) was slightly wider, darker and often warmer in tone than the SEB(S). Higher resolution images revealed a narrow belt which lay in the EZ between the SEB(N) and EZB (Figures 3a, 4c, 4d, 4h, 4i and 5) which was also visible during the previous apparition (Figure 7).

The most significant feature in the SEB(Z) was a light spot which was followed for much of the apparition. This is designated as spot no. 1 in Table 6. Typical observations of this spot are shown in Figures 2, 9a and 9b. It spanned approximately 4º to 5º in longitude and was often more easily imaged in green light.

It had a rapid prograde motion of –7.1° per day with respect to System 3 (or a retrograde motion of +26.4° per day relative to System 1). Figure 10 shows the positions of this spot vs. time in a longitude system which is moving at 7.1° per day faster than System 3. The longitudinal drift of this spot relative to this new longitude system is therefore zero.

A small number of other light spots was also recorded in the SEB(Z) and their positions are also shown in Figure 10. A few of these only appeared in highly processed images. However images taken by Tyler on March 15 (Figure 11) and by Peach on March 25 (Figure 9c) each show a distinct SEBZ spot. These are located at longitudes of 46º and 30º in Figure 10.

Peach and Vandebergh sometimes recorded dark spots on the SEB(S) which lay approximately 35º f. white spot no.1, as also shown in Figure 10. Some of these appeared to project into the SEB(Z), as shown in Figure 2. As well as recording white spot no. 1 on April 12, Arditti also recorded a small light spot at this longitude, although this was not recorded by Peach or Tyler on the same night. It is possible that these observations may be of a single feature but there is insufficient certainty in the observations to be sure.

Some dark SEB(N) spots were sometimes recorded visually (Abel on April 28, Gray on March 14, Hancock on March 12 and McKim on April 21) but there were no other observations of these features.

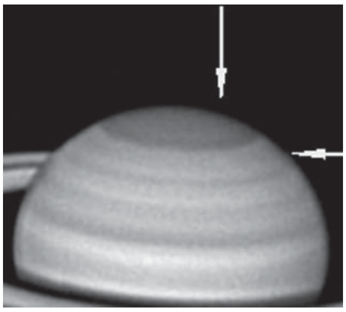

Figure 8. 2007 Apr 18d, 20h 13m UT. CM1= 217.0, CM2= 78.0, CM3= 38.7. *(Peach).* Green light image of a spot on the SSTB. This spot is also faintly visible in Figure 6.

The Equatorial Zone (EZ)

The EZ was divided by a broad EZ band (EZB). The EZ(S) was the brightest zone on the planet and generally appeared white or yellowish white. A narrow segment of EZ(N) was visible between the EZB and where ring C was projected onto the planet. The EZ(N) was easier to observe in the second half of the apparition than the first half due to the higher polar tilt as seen from the Earth.

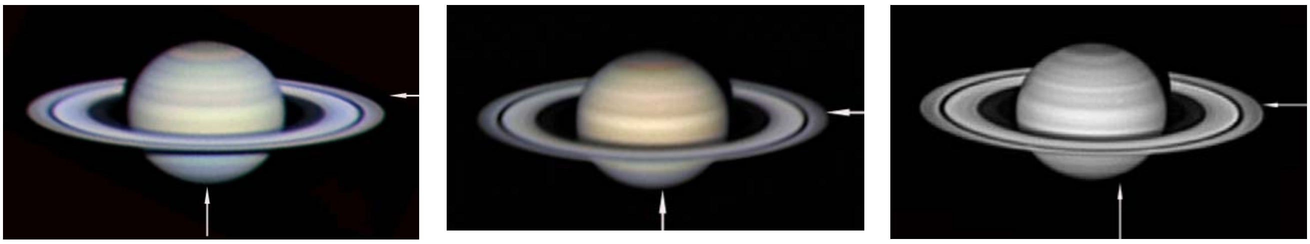

Figure 9. White spots in the SEBZ.

9a *(left)***.** 2006 Nov 29d, 04h 35m UT. CM1= 258.2, CM2= 342.3, CM3= 112.6. *(Lawrence).* SEBZ white spot no. 1 is on the CM. The reddish coloured zone in the SPR and the faint North Tropical Band are also shown.

9b *(centre)***.** 2007 Mar 17d, 21h 17m UT. CM1= 238.2, CM2= 51.2, CM3= 50.5. *(Casquinha).* SEBZ white spot no. 1 is approaching the CM.

9c ***(right)*****.** 2007 Mar 25d, 21h 25m UT. CM1= 157.1, CM2= 71.6, CM3= 61.2. *(Peach).* High contrast red light image showing a white spot in the SEBZ.

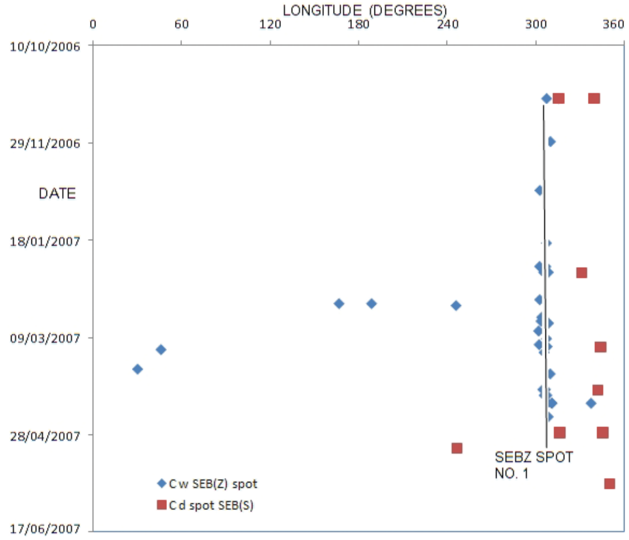

Figure 10. Drift chart of the white spots observed in the SEBZ and the dark spots observed on the SEB(S). This chart has been generated in a longitude system that moves at 7.1° per day faster than System 3. At opposition, the System 3 longitude of spot no. 1 was identical to its longitude within this modified system (i.e. 306.9°). Positions were derived from images by Arditti, Casquinho, Lawrence, Peach, Tyler, Vandebergh and Yukoni plus visual Central Meridian transits by Gray.

Latitude measurements of the EZB (Table 3) indicate that it was not positioned symmetrically about the planet's equator.

During March and April, a few light spots were intermittently recorded in this zone. Some images by Peach, Tyler and Eheim & Vedovato showed spots in the EZ(S) such as shown in Figure 11. Some images by Vandebergh recorded dark spots on the EB or light spots in the EZ(N). As with most other observed spots, all of these were observed on one night only and may have been temporary features.

The northern hemisphere

Overall, the northern hemisphere appeared a bluish grey colour and this cold tone contrasted with the warmer tone of the southern hemisphere. This is shown in the various colour images contained in this report. This colour was also noticeable to visual observers and a typical observation was made by McKim on January 7, who recorded the northern hemisphere as blue compared to the yellowish tone of the southern hemisphere.

The most striking feature in this hemisphere was the narrow turquoise or bluish coloured zone shown in many of the figures of this report including Figure 5. This was designated as the North Tropical Zone (NTropZ) by many observers, and this terminology is used in this report.

The northern edge of this zone was marked by the North Temperate Belt (NTB). However a distinct southern edge to the zone was not detected. Early in the apparition, the southern boundary edge of this zone was limited by the northern edge of the shadow of the rings onto the globe. During October, this shadow extended to an approximate latitude of +29° (measured on the planet's CM). From around the time of opposition until the last observation of this apparition, the southern boundary of the NTropZ was limited by the northern edge of the projection of Ring A onto the planet. At best, the southern boundary of this zone was observed down to a latitude of approximately +23° (again, measured on the planet's CM).

High resolution images sometimes revealed the bluish zone to be crossed by a faint narrow belt which was designated as the North Tropical Band (NTropZB) by some observers. This had an approximate latitude of 32°N. When this band was recorded, the colour of the NTropZ immediately to the north often appeared less intense than that to the south (Figure 9a).

Although this zone has been designated as the NTropZ, a very preliminary assessment of belt latitudes for the 2007/2008 apparition[6] indicates that the turquoise colour extended down to latitudes compatible with that of the NEB. However these latitudes will be investigated further when a more detailed analysis of the 2007/2008 observations has been completed.

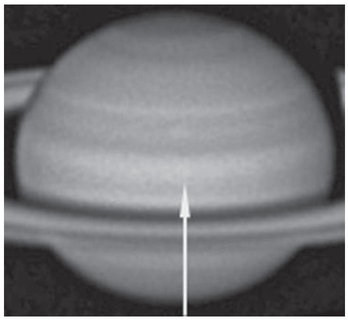

Figure 11. 2007 Mar 15d, 19h 37m UT. CM1= 290.9, CM2= 170.8, CM3= 172.5. *(Tyler).* A faint spot in the EZ(S) is approaching the CM. An SEBZ spot is also visible near to the CM.

The NTB appeared double in some of the highest resolution images and the northern component generally appeared slightly darker than the southern.

High resolution observations sometimes revealed a narrow light zone between the NTB and the north limb of the planet. This was probably the North Temperate Zone (NTZ). The region around the northern limb was shaded. A darker edge is shown on some images and this was also frequently recorded by Gray as the North North Temperate Belt.

The rings

Introduction

High resolution observations revealed a number of lighter and darker regions and 'bands' on both Ring A and Ring B. These are shown in Figure 12 and in a number of other figures of this report.

A typical high resolution image taken by the *Cassini* space-

Table 6. Longitudes and drifts, 2006/2007

Spot no.	*Description*	*Latitude (°)*	*L3 (O)*	*DL3*	*Rotation period*	*Dates*	*No. of obsns*
1	White Spot SEBZ	–28	306.9	–213	10h 33m 49.4s	2006 Nov 7 to 2007 Apr 19	24

The quoted latitude is Saturnographic. L3(O) is the System 3 longitude at opposition on 2007 February 10. DL3 is the drift relative to System 3 in degrees of longitude per 30 days.

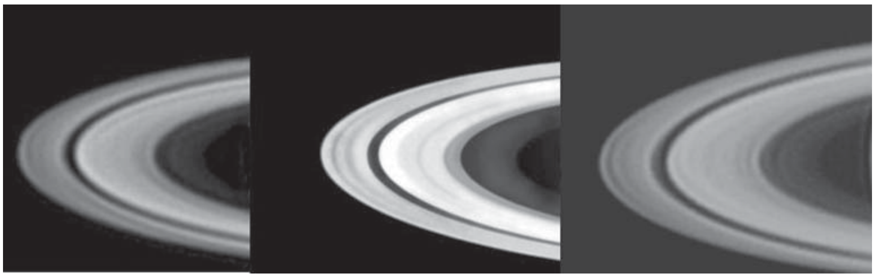

Figure 12. Detail in the rings. This figure shows observations of the p. ansa. *Left:* 2007 April 14d 20h 50m UT. (Image by Tyler). *Centre*: 2007 April 14 20h 40m UT. (Drawing by Gray). *Right*: 2007 April 18d 19h 57m UT. (Image by Peach).

craft (Figure 13 left) was used to confirm the existence of these features. The resolution of this image is far higher than could be obtained from the Earth. Consequently a Gaussian blur filter was applied to the image in order to degrade the resolution to that which might be observed under good conditions from the Earth. The resulting processed image is shown in Figure 13 right. Generally only the albedo features are shown and the ringlets shown in the high resolution image have disappeared.

Some of the very best images coupled with Figure 13 were measured to establish the approximate radial positions of each of the darker regions and 'bands'. These positions are given in terms of the percentage of the width of the applicable ring measured outwards from the ring's inner edge. Consequently for Ring A, its inner edge, at the boundary of the outer edge of Cassini's Division, has a position of 0%, whereas the outer edge of Ring A is 100%. Similarly for Ring B, the inner edge at the boundary with ring C has a position of 0% where the outer edge of ring B has a position of 100%.

Given that the measurements were approximate, there is a good match between the measurements from the *Cassini* image (given in Figure 13 right) and those derived from the amateur images.

Ring A

Medium resolution observations of Ring A showed that it was divided into a darker outer section and a brighter inner section. These are classically designated as Rings A1 and A2 respectively (see Figure 12 and several other figures of this report). The outer boundary of A2 lay at approximately 14% (The position derived from the *Cassini* image is 16%).

Higher resolution observations (e.g. Figure 12) revealed a broad region within Ring A1. This was darker than A2, and extended from the outer edge of A2 up to approximately 78%. This region was, in turn, divided by a narrow darker band which extended from approximately 42% to 55%. (The position derived from the *Cassini* image is in the range 44% to 56%). Figure 13 right also shows this band with a distinct outer edge and less distinct inner edge.

The best observations also showed a narrow dark line centred at 78% which corresponded to the position of what is now designated as the Encke Gap.[7] The region from Encke's Division to Ring A's outer edge was light.

A few images show a darker band at the A1/A2 boundary which also appears in Figure 13 right.

Some of these darker bands may have been interpreted as 'divisions' in the lower resolution observations.

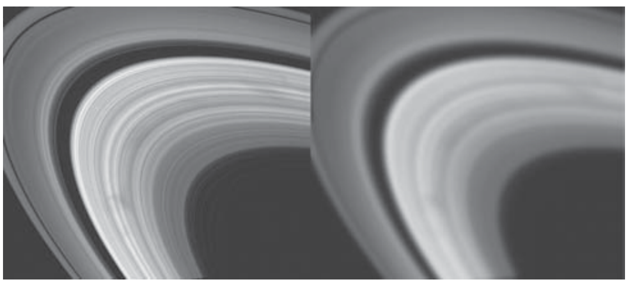

Figure 13. The appearance of the rings as seen by the *Cassini* spacecraft. *Left:* Image taken with the wide angle camera on 2008 August 21. This shows the Cassini Division and the Encke gap, many ringlets and some radial 'spokes' on Ring B. *Right:* The same image with a Gaussian blur applied in order to reduce the image resolution to be comparable to that seen under good conditions from the Earth. *(Copyright NASA)*

The Cassini Division

With sufficient aperture and good seeing, the Cassini Division appeared black and could be observed all around the ring system, except where it lay behind the planet or was hidden by the globe shadow on the rings. In particular, the sector of the Division projected against the planet generally appeared black, as the ring shadow projected against the planet was generally visible through this sector.

However images taken between February 1 to Feb 12 by Casquinha, Lawrence, Peach and Tyler showed this sector to be light rather than dark. In some images the p. and f. limbs of the planet could be faintly seen. A typical example of these observations is shown in Figure 4c. Most of these images had good resolution. This light appearance was due to the illuminated planet being seen though the Division.

Sunlight passing through the Cassini Division produces a relatively narrow illuminated strip within the ring shadow where projected onto the planet. Under certain conditions, this illuminated strip may be observed from the Earth through the Cassini Division.

In the early part of the 20th century, C. T. Whitmell[8] noted that the best conditions to observe the illuminated strip of Saturn planet through the Division were:

1. The Saturnicentric latitude of the Earth (B)= the Saturnicentric latitude of the Sun (B').
2. B and B' should be as large as possible.
3. The Saturnicentric right ascensions of the Sun and Earth should be equal.

Further, the noted expert in celestial mechanics, M. Jean Meeus confirmed[9] that a necessary condition to observe the planet through the Division near to the CM would be for B= B'.

Such conditions existed around the time of opposition during this apparition, with B= B' shortly before opposition (Figure 1). In addition, Grischa Hahn[10] of the *WinJUPOS* team subsequently used the *WinJUPOS*[2] software to show the illuminated strip of planet was visible through the Cassini Division at this time. This was also later confirmed by the Director using the *Redshift* software.[11]

However this was not the only time when the illuminated planet could be detected through the Division. *WinJUPOS*[2,10] and *Redshift*[11] simulations made for spring 2007 showed that the northern edge of the ring shadow extended a little further south at the planet's p. limb as seen from the Earth. Most of the northern edge of this shadow was hidden by Ring A. However from April until mid-June, this southerly extension allowed a short segment of illuminated planet, to the north of the shadow, to be visible through the Division near to the planet's p. limb. The rest of the Division projected onto the planet was dark as only the shadowed surface of the planet was visible through it.

This effect was imaged during April by many observers with telescope apertures of 20cm and above in good seeing. A typical example of these observations is shown in Figure 5. However this effect was not recorded in images taken after April, probably due to poorer seeing.

Ring B

Ring B was the brightest ring. Even lower resolution observations showed that it was divided into a brighter outer section and a slightly darker inner section (designated Ring B1 and Ring B2 respectively). The brightest section of Ring B extended from the Cassini Division to approximately 92% (the position derived from the *Cassini* image is approximately 91%). Some high resolution observations indicate a darker boundary here but this is not shown in the *Cassini* image.

The best observations showed a faint band at 75% to 78% (the positions derived from the *Cassini* image are in the range 72% to 79%) and a much darker band at 50% to 60% (*Cassini* image – 46% to 59%).

A darker region was also observed close to Ring B's inner edge extending from 15% to 38% (*Cassini* image – 18% to 38%). Two darker bands were sometimes recorded in this region (Figure 12) and these also appear in the degraded *Cassini* image.

Ring C

This was difficult to record in each ansa but Adamoli glimpsed it with a relatively small aperture (Figure 3b).

The 'Opposition Effect'

If the phase angle between the Sun, Saturn and the Earth becomes less than 0.3°, a surge in ring brightness is observed. This is called the Opposition or Seeliger Effect. (Arditti has provided a brief description of this phenomenon and details of observations he made of this effect at the 2008 opposition.[12])

For this apparition, the phase angle reached a minimum of 0.14° a few hours after opposition.

No observations were made on the day of opposition (February 10). However Tyler imaged the planet on Feb 9 at 00:10 UT and recorded the rings as brighter than normal, although this observation was made in poor seeing.

Other aspects of the rings

During April and May, a number of observers noted that Ring B did not appear as bright as usual (Gray via intensity observations, McKim on April 29 and Parish on May 20.) Saturn was at quadrature on April 20.

Graham and Heath sometimes recorded the Terby's white spot (Figure 3c) which is a contrast effect between the globe shadow on the rings and the bright Ring B.

The shadows

The Globe Shadow on the Rings (SH G on R)

Before opposition, the SH G on R was projected onto the southern arm of the p. ansa.

As opposition approached, this shadow became narrower. Tyler made the last observation before opposition (during the early hours of February 9) and his image showed that this shadow was still visible p. the planet.

No observations were received for the day of opposition and indeed very few were received for the few weeks after opposition.

The first observation after opposition was also made by Tyler on the night of Feb 12. The shadow wasn't obvious, although his image showed some shading on Ring B immediately where it disappeared behind the planet's p. and f. limbs. There were no further observations until Feb 18 (Yunoki) when the shadow was easily visible on the southern arm of the rings f. the planet.

The movement of this shadow is illustrated in Figures 3 and 4.

The Ring Shadow on the Globe (SH R on G)

Before opposition, this shadow was projected onto the planet's northern hemisphere, north of where Ring A crossed the planet (Figure 3a).

It then appeared narrower, and shortly before the date of opposition it was hidden by the rings. On January 7, McKim observed this shadow through Ring C(M) but only at the extremities. After opposition, this shadow became visible through Ring C where it crossed the planet (Ring C(M)). The movement of this shadow is illustrated in Figures 3 and 4.

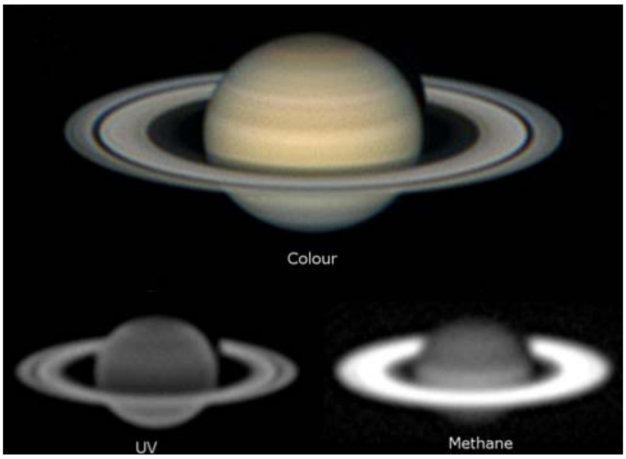

Figure 14. A comparison of the appearance of Saturn in colour, UV, and IR (methane) wavelengths on the same night by Pujic. The colour image was taken on 2007 Mar 16d, 11h 34m UT. CM1= 132.2, CM2= 350.6, CM3= 351.6. The UV image was taken at 12h 21m and the IR (methane) image at 12h 52m.

Filter observations

Images taken in the infrared (IR) methane band (>890nm) and in the ultraviolet (UV) band (<390nm) reveal the high altitude haze in Saturn's atmosphere. This haze reflects in the IR but absorbs to a variable degree in the UV.[4]

Peach, Pujic, Vandebergh and Yunoki each imaged the planet using IR and UV filters at wavebands at or close to those given above (see Table 2). The use of these filters required longer exposures to image the planet compared to more conventional filters. The typical appearance of the planet and the rings at these wavelengths is shown in Figure 14.

In these filters, the rings had a similar appearance to that observed in white light (i.e. Ring A, the Cassini Division and Ring B were visible). In some IR images, Ring B appeared very bright.

The most obvious planetary feature was the EZ which was visible in both wavebands and extended south to the SEB latitudes. It appeared dark in UV but bright in IR.

The latitudes of the SEB were light in UV but dark in IR. This region extended slightly further south in the UV band compared to white light.

In UV, the STB and STZ latitudes appeared dark and light respectively. However, in IR these latitudes appeared light.

The SPR latitudes appeared dark in both wavebands, especially in IR.

The northern hemisphere was dark in IR. In UV, the NTropZ latitudes were dark but the rest of this hemisphere appeared lighter up to the northern limb.

The planet's limbs appeared bright in UV.

The satellites

General

The five major satellites, Titan, Iapetus, Rhea, Dione and Tethys, were frequently observed, either by visual means or digital imaging techniques.

Heath observed Titan visually using a number of colour filters. No obvious difference in appearance was recorded but on some nights, Titan appeared slightly fainter in a red filter (Wratten 25) compared to a blue filter (Wratten 44a). On other nights, the opposite was observed.

The transit of Iapetus

A major event of this apparition was the successful observation of the initial phase of a transit of Iapetus across the globe of Saturn on 2007 January 6/7. This was achieved visually by Gray, Heath and McKim. Heath used a 250mm Newtonian whereas Gray and McKim were able to use much larger instruments (415mm and 410mm Dall–Kirkham telescopes respectively) as shown in Figure 15.

The major satellites, from Titan inwards, orbit Saturn with small inclinations to the planet's equator and hence to the plane of the rings. Transits, occultations and eclipses of these satellites only occur when the apparent inclination of their orbits as seen from the Earth is sufficiently small. Such conditions only exist for a few years either side of the time when the rings appear edge-on.

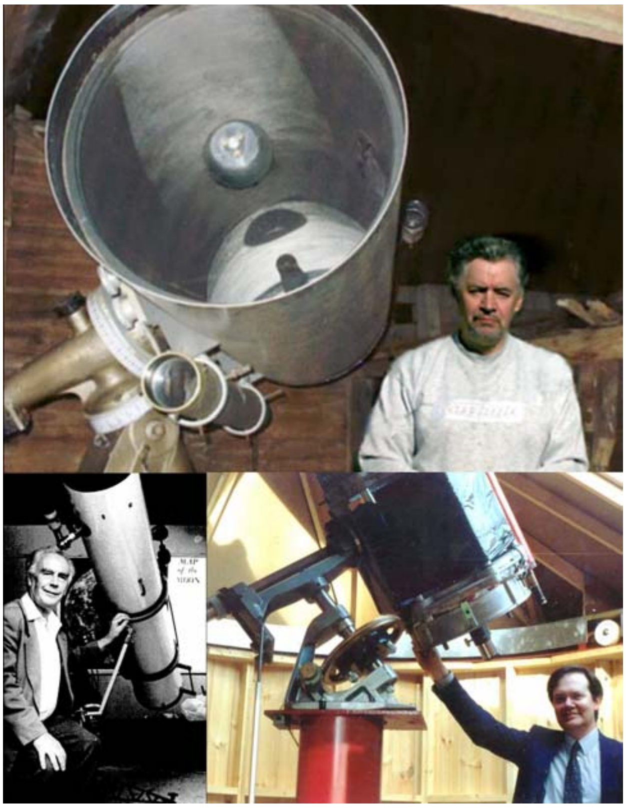

Figure 15. The observers of the transit of Iapetus with their respective telescopes. *Upper:* David Gray; *Lower left:* Alan Heath; *Lower right:* Richard McKim.

However, the orbit of Iapetus is inclined at approximately 14º to the plane of Saturn's equator (and at approx. 18º to the ecliptic). Consequently suitable conditions for transits, eclipses and occultations occur approximately two years before each ring plane crossing. Even when these conditions are fulfilled, the number of transits and occultations that may occur is limited due to the long orbital period of this satellite (approximately 79 days). Finally, the detection of transits is difficult due to the small apparent angular size of the satellite. Its faint magnitude also makes the observation of occultations rather difficult.

Suitable conditions for such events did occur during 2006/2007. The *WinJUPOS*[2] software was used to search for these events and a small number of transits and occultations was identified commencing on 2006 October 19 and finishing on 2007 July 23/24. During some events, Iapetus transited across or was occulted by the rings.

On 2007 January 6/7, Iapetus was predicted to transit across the rings and the planet. The predicted times given coupled with Figure 16 were derived from *WinJUPOS*.[2] Figure 16 shows the predicted position of Iapetus at two specific times during the occultation.

Transit ingress across the Sf. arm of the rings was predicted for approximately 22h 10m UT. Transit ingress across the planet was predicted for approx. 23h 36m and occurred at a point where the Cassini Division disappeared behind the f. limb of the planet (Figure 16). The satellite then tracked Np.

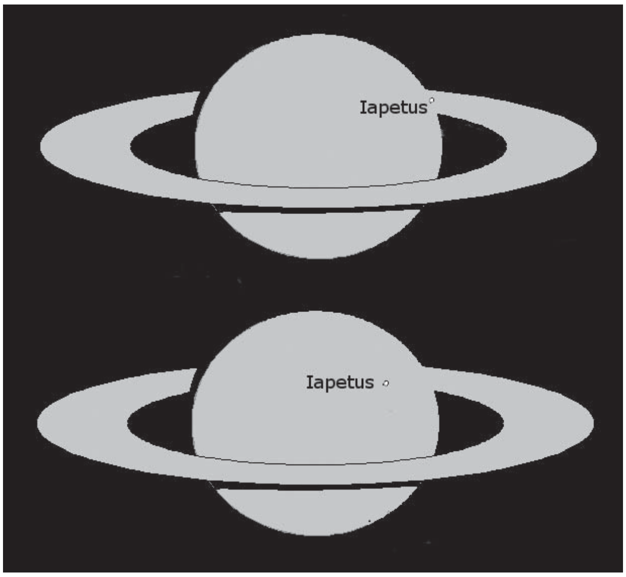

Figure 16. Predicted positions of Iapetus during transit on 2007 Jan 6/7 from the *WinJUPOS*[2] software. *Upper:* The position at 23h 36m UT. *Lower:* The position at 01h 20m UT. Note that Mimas and its shadow were also predicted to be in transit against the northern hemisphere at this time.

across the SEB to leave the planet on the p. limb at approx. 09h 10m UT. Transit egress from the Np. ansa of the rings was predicted for approx. 15h 15m UT.

Gray, Heath and McKim each attempted to observe this event, but all three observed under difficult conditions. In addition, the Moon lay to the east of Saturn, having been full on Jan 3 at 1h 57m. Gray and McKim were in e-mail contact during the event.

Heath observed through thin cloud. Although using the smallest telescope of the three observers, he suspected a faint spot on the f. side of the globe around 23h 55m UT. This spot lay just south of the SEB. Although only suspected, this location is in very good agreement with the predictions for the time of the observation. Heath estimated the spot to be intensity 3 and not as dark as the SEB. Clouds prevented any further observation.

McKim commenced observing at 23h 50m, with gusting wind, scudding cloud and poor seeing. The seeing improved slightly between 00h 40m to 00h 55m, during which he was able to glimpse the satellite as a small dark grey spot projected against the southern edge of the SEB(S), as shown in Figure 17a. By 01h 05m, thickening clouds prevented further observation.

Gray also experienced frequent cloud cover and strong winds, but under better seeing, was able to observe the satellite as a small intensely dark spot on the southern edge of the SEB(S) after 01h 05m (Figure 17b).

All observations are in good agreement with the predictions. McKim has researched the BAA archives and believes that this may be the first record of such an event within the BAA.[13] The low inclination of the orbit of Iapetus as seen from the Earth also allowed this satellite to be observed close to the other brighter satellites when it lay close to conjunction with Saturn (Figure 18).

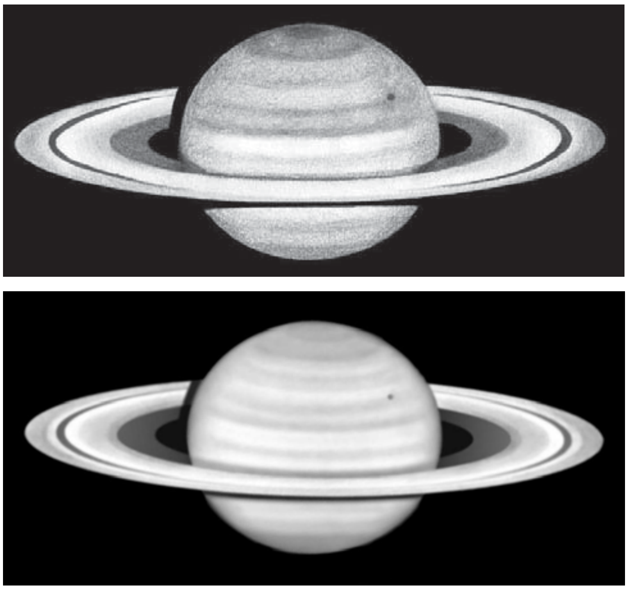

Figure 17. Observations of the transit of Iapetus. In both drawings Iapetus is the small dark spot on the SEBs near to the f.limb.

17a *(top)***.** 2007 Jan 7d, 00h 55m UT. CM1= 300.3, CM2= 209.5, CM3= 292.9. *(McKim).*

17b *(bottom)***.** 2007 Jan 7d, 01h 20m UT. CM1= 315.0, CM2=223.6, CM3= 307.0. *(Gray).* Compare the position of Iapetus with the predicted position shown in Figure 16.

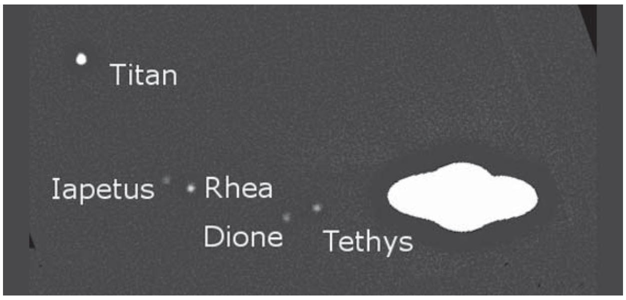

Figure 18. 2007 May 1d, 20h 31m UT. *(Vandebergh)* This shows Iapetus with the four other bright satellites.

Lunar occultations

Several lunar occultations of Saturn were predicted to occur during 2007.[1]

The occultation predicted for March 29 was only visible from the northern British Isles, whereas those for March 2 and May 22 were visible from a greater area of the UK. These latter two events were widely observed. The observational

Figure 19. Lunar occultation of Saturn on 2007 Mar 2d, 02h 44m UT. *(Tyler).* The occultation was only a graze from Tyler's location.

Figure 20. The lunar occultation of Saturn on 2007 May 22. **20a** *(left)***.** 2007 May 22d 19h 15m *(Sussenbach)*. This shows the disappearance of Saturn at the Moon's dark limb. **20b** *(right)***.** 2007 May 22d 20h 55m (approx.) 90mm Maksutov *(Val & Andrew White)*. Shows the reappearance of Saturn from the Moon's bright limb close to the Mare Smythii.

reports (including a list of observers) for both of these events have been previously reported in the BAA *Journal*.[14,15] Since these reports were published, further observations of the March occultation have been received from Arditti, Diana Parsons (254mm Schmidt–Cassegrain, Milton Keynes) and Val & Andrew White (Culcheth). Simon Kidd (Welwyn, Herts), Sussenbach and the Whites (observing at St George's Bay, Malta) provided reports of the May occultation. Figures 19 and 20 show typical observations of both of these events.

Acknowledgments

The author would like to thank M. Jean Meeus for his assessment of the conditions necessary for Saturn to be visible through the Cassini Division, Grischa Hahn for the *WinJupos* simulations showing the visibility of the planet through the Cassini Division, and Sheridan Williams for providing a copy of the C. T. Whitmell paper.[8]

Address: 2 The Hawthorns, Henlow, Beds. SG16 6BW. [mike.foulkes@btinternet.com]

References

1 *Astronomical Almanac*, 2007
2 *WinJUPOS* freeware software available for download from: **http://jupos.privat.t-online.de/index.htm**
3 *Registax* freeware software available for download from: **http://www.astronomie.be/registax/**
4 Rogers J. H., Mettig H.–J., Foulkes M., Peach D., & Cidadão A., 'Jupiter in 2001/2002: Part 1', *J. Brit. Astron. Assoc.*, **118**(2), 75–86 (2008)
5 'Saturn during the 2005/2006 apparition': Report in preparation
6 'Saturn during the 2007/2008 apparition': Report in preparation
7 BAA *Handbook* 2007
8 Whitmell C. T., *J. Brit. Astron. Assoc.*, **28**, 24 (1918)
9 J. Meeus & M. Foulkes, *private communications*, 2008 May
10 G. Hahn & M. Foulkes, *private communications*, 2008 August
11 *Redshift* software see: **www.mm.co.uk**
12 Arditti D., 'Saturn and the 'Opposition Effect', *J. Brit. Astron. Assoc.*, **118**(2), 106 (2008)
13 R. McKim to M. Foulkes, *private communication*, 2007 May 30
14 Foulkes M., 'Occultation of Saturn by the Moon, 2007 March 2', *J. Brit. Astron. Assoc.*, **117**(2),142–143 (2007)
15 Foulkes M., 'A daylight occultation of Saturn', *J. Brit. Astron. Assoc.*, **117**(4), 168 (2007)

Received 2009 June 15; accepted 2010 January 27

BAA Membership

The subscription rates for the 2010–2011 session are as follows:

Young Persons' membership (22 years of age or under on 1st August) £18.00
Ordinary Members (23–64) £44.00
Senior Members (65 or over) £31.00
Affiliated Society £44.00

Members with 50 or more years' continuous membership, no charge

Family Membership:
Where both members are under 65 on 1st August £48.00
Where one or both members are 65 or over £33.00
Family Membership is available for two people living at the same address. Only one *Journal* and *Handbook* will be sent although both may attend meetings and have a vote.

Paper *Circulars* (if required):
UK & Europe £5.00
Rest of World £10.00

Postage
Overseas postage by surface mail for the *Journals* and *Handbook* is included in the above rates. To avoid postal delays and losses use of airmail is strongly recommended. Please add the following for airmail:

Europe (including the Canary Islands and Turkey) £12.00
Rest of World £19.00

Overseas members may send a sterling cheque, arrange payment in sterling on a UK bank, or pay by credit card using the BAA's secure website **www.britastro.org**. Please note that we do not hold a continuous credit card facility, so your payment must be renewed every year.

UK members are particularly asked to save administrative costs and time by paying their subscriptions by Direct Debit: please contact the Office for the necessary form.

Gift Aid
UK Income Tax payers are urged to complete a Gift Aid certificate for their subscriptions and other donations. Please request a Gift Aid form from the Office if you have not previously completed one. The BAA can claim a tax refund at any time during the year.